PART A: Short Answer – Write only the final answer in the space provided. [24 marks]

1. How many solutions are there to the following systems of linear equations?

   (a) $y = \frac{2}{3}x + 4$ and $y = 3x - 7$ — one

   (b) $y = \frac{1}{5}x + 2$ and $y = \frac{1}{5}x - 2$ — None

2. Factor completely:

   $m^3n^2 + m^2n^3$ — $m^2n^2(m+n)$

3. State the equation of a circle with centre (0, 0) and radius 5. — $x^2 + y^2 = 25$

4. What is the slope of the line segment joining C(8, 17) and D(-1, 26)? — $9 / -9 = -1$

5. State the zeros of the equation $(2x+6)(x-4) = 0$ — $x = -3$ & $x = 4$

6. Expand and simplify $2(x-1)^2 + 3$ — $2x^2 - 4x + 5$

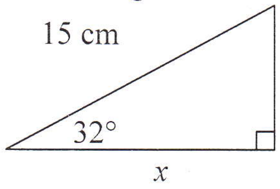
7. Name the three tree transformations on $y = x^2$ that would give you the graph of $y = -2(x-4)^2$. — reflection in the x axis vertical stretch by a factor of 2 Horizontal translation right 4

8. Evaluate $\tan 56°$ to 3 digits after the decimal. — 1.483

9. True or false? If two triangles are similar then they are congruent. False

10. Given $\sin\theta = 0.5$, find θ. — $= 30°$

11. Calculate the length of the indicated side: — 12.72 cm



12. Name the intersection point of the three medians of a triangle — centroid

13. What is the first step needed to solve $x^2 - 4x = 60$? — Rearrange – 60 to the left side

14. For the parabola $y = -3(x-2)^2 - 4$, state:

(a) the vertex (2, -4)

(b) the equation of the axis of symmetry: x = 2

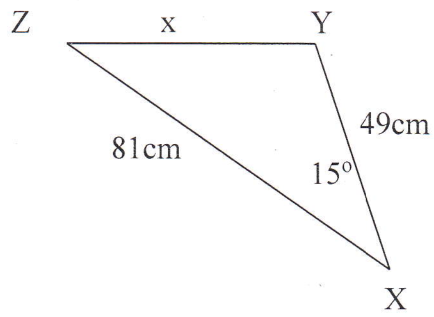
15. If $y = 3x + 7$ represents the equation of a line AB, which of the following equations could represent the equation of a line perpendicular to AB?

a) $y = -3x + 2$ b) $y = \frac{1}{3}x + 2$ c) $y = -\frac{1}{3}x + 2$ C

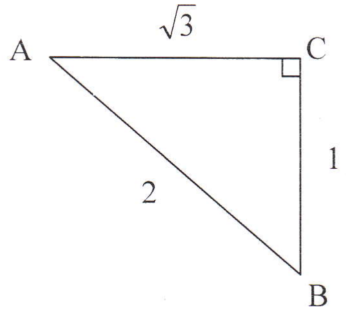
16. In a triangle, the perpendicular distance from a vertex to the opposite side is called: Altitude (Height)

17. Is the point (3, 4) on the line defined by $2x + 4y = 22$? Yes or No? Yes

18. What formula would you need to solve for x? Law of Cosine



19. For the following triangle:



(a) State sin B *(exact answer only)* $\sin B = \frac{\sqrt{3}}{2}$

(b) Find $\angle B$ $\angle B = 60^\circ$

Part B: Provide full solutions for all questions in the space provided. [64 marks]

1. Solve the system of equations algebraically by the method of your choice.

[5] 1) $2x + y = 5$ 2) $x - 2y = 10$ x 2

1) $2x + y = 5$

Subtract 2) $2x - 4y = 20$

POI (4,-3)

5y = -15

$$\frac{5y}{5} = \frac{-15}{5}$$

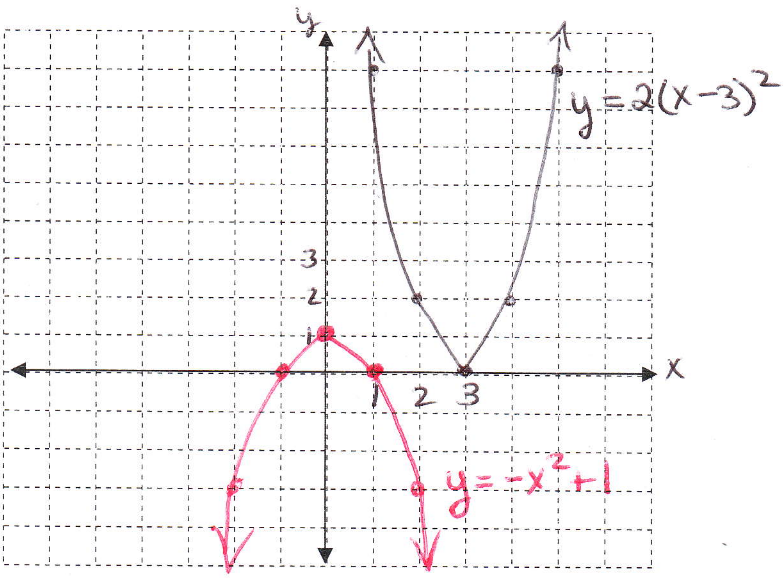
y = -3 plug into 2)

x – 2(-3) = 10
x +6 = 10
x = 4

2. Graph and label the following functions on the grid provided.

[2] (a) $y = 2(x-3)^2$ Vertex (3,0) step pattern (2,6,10)

[2] (b) $y = -x^2 + 1$ Vertex (0,1) step pattern (-1,-3,-5)



3. Determine the distance between the points A(2, -4) and B(-3, -1).

[2] $AB = \sqrt{(-5)^2 + 3^2}$
$= \sqrt{34}$
= 5.83 units

4. Using finite differences, classify the following relation as linear, quadratic or neither.

[2]

x	y	First Differences	Second Differences
-2	-8	--	--
-1	-1	7	--
0	0	1	-6
1	1	1	0
2	8	7	6

The relation is - - - - - Neither

5. Factor completely.

[2]

(a) $15ab + 20a - 6b - 8$

5a(3b + 4) – 2(3b +4)
(3b + 4)(5a-2)

(b) $5a^2 - 11a + 2$

(a-2)(5a-1)

[3]

(c) $8x^2 - 50$

$2(4x^2 - 25)$

[3] 2(2x - 5)(2x + 5)

(d) $m^2 - 12mn + 36n^2$

$(m - 6n)^2$

[2]

6. Solve each of the following equations.

(a) $2x^2 - 3x + 1 = 0$

(x - 1)(2x - 1) = 0

[4]

x = 1 or x ½

(b) $3.2x^2 + 28.9x - 8.4 = 0$

$$x = \frac{-28.9 \pm \sqrt{28.9^2 - 4(3.2)(-8.4)}}{2(3.2)}$$

$$= \frac{-28.9 \pm \sqrt{942.73}}{6.4}$$

$= 0.28$ or -9.31

[4]

(c) $x^2 + 10 = 0$

$x^2 = -10$

[1] $x = \pm\sqrt{-10}$ no real roots

7. Find in, $y = a(x-h)^2 + k$ form, the equation of the parabola with a vertex at (6, 2) which passes through (3, 20).

$y = a(x-6)^2 + 2$ sub in (3,20)

$20 = a(3-6)^2 + 2$

$18 = 9a$

[3] $a = 2$ therefore $y = 2(x-6)^2 + 2$

8. For the parabola defined by $y = -2x^2 - 12x - 14$, change the equation into vertex form $y = a(x-h)^2 + k$.

$y = -2x^2 - 12x - 14$

$y = -2(x^2 + 6x + 7)$

$y = -2(x^2 + 6x + 9 - 9 + 7)$

[4] $y = -2[(x+3)^2 - 9 + 7]$

$y = -2[(x+3)^2 - 2]$

$y = -2(x+3)^2 + 4$

9. Find the equation of the right bisector of the line segment with endpoints A(4, -7) and B(-7, 4).

$M_{AB} = \dfrac{-7+4}{2}, \dfrac{4-7}{2}$

$= -\dfrac{3}{2}, -\dfrac{3}{2}$

$Slope_{AB} = \dfrac{-7-4}{4--7} = \dfrac{-11}{11} = -1$

Slope of right bisector = 1

y = mx + b

y = 1x + b sub in midpoint

-3/2 = -3/2(1) + b

b = 0

[5] therefore y = x

10. Prove that ΔABC is similar to ΔPQC.

[3]

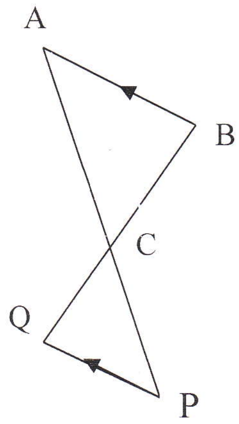
In $\triangle$ ABC and $\triangle$ PQC

$\angle A = \angle P$ parallel lines (alternate angles are equal) (Z patte

$\angle B = \angle Q$ parallel lines (alternate angles are equal) (z patte

$\angle ACB = \angle PCQ$ (opposite angle theorem)

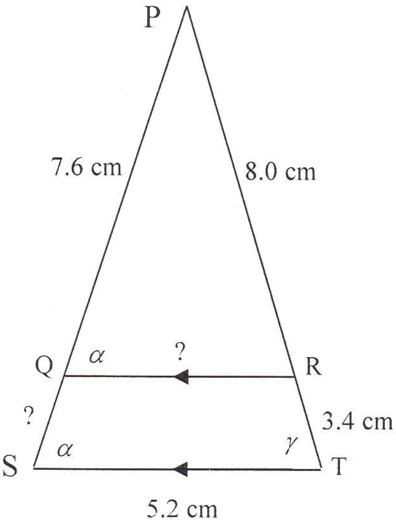
therefore $\triangle$ ABC $\approx$ $\triangle$PQC (AAA)



11. Given that ΔPQR is similar to ΔPST.

If $PR = 8.0$ cm, $PQ = 7.6$ cm, $ST = 5.2$ cm

and $RT = 3.4$ cm, find QR and QS.



[4] $\Delta PQR \approx \Delta PST$

$$\frac{PQ}{PS} = \frac{PR}{PT} = \frac{QR}{ST}$$

$$\frac{PQ}{PS} = \frac{PR}{PT} = \frac{QR}{ST}$$

$\text{PS} = \dfrac{7.6(11.4)}{8}$ $\qquad$ $\text{QR} = \dfrac{8(5.2)}{11.4}$

PS = 10.83 $\qquad$ QR = 3.65

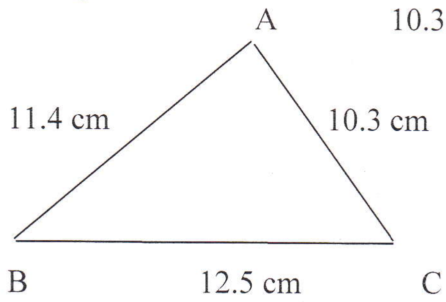
QS = PS – QR

QS = 10.83 – 7.6 = 3.23

Therefore QR = 3.65 cm and QS = 3.23 cm

12. Solve for the indicated values.

[3] (a) Find angle B.



10.32 = 11.42 + 12.52 – 2(11.4)(12.5)cosB

$$\cos B = \frac{10.3^2 + 11.4^2 - 12.5^2}{2(11.4)(121.5)}$$

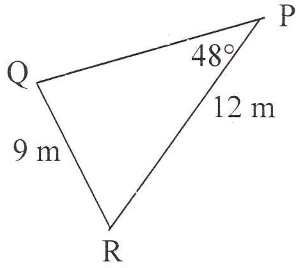
$$\cos B = \frac{180.12}{285}$$

cosB = 0.632

B = 0.632 $\cos^{-1}$

B = 50.8°

[4] (b) Find angles Q and R.



$$\frac{\sin 48}{9} = \frac{\sin Q}{12}$$

$$\angle R = 180 - 48 - 82.25$$

$$\angle R = 49.75$$

$$\sin Q = \frac{12 \sin 48}{9}$$

$$\sin Q = 0.9908597673$$

$$Q = 0.9908597673 \sin^{-1}$$

$$Q = 82.25^{\circ}$$

13. For the quadrilateral ABCD, where A(0, 0), B(3, 5), C(8,6), D(5,1): (make sure you make a diagram to correctly place the coordinates)

[3] (a) prove that AB is parallel to CD.

$\text{Slope}_{AB} = \frac{5}{3}$ & $\text{Slope}_{CD} = \frac{5}{3}$

Therefore AB || CD

[3] (b) prove that the diagonals of the quadrilateral bisect each other.

$\text{Midpoint}_{BD} = \left(\frac{3+5}{2}, \frac{5+1}{2}\right) = (4,3)$ $\text{Midpoint}_{AC} = \left(\frac{8+0}{2}, \frac{6+0}{2}\right) = (4,3)$

The midpoint BD and the midpoint AC are the same

PART C: APPLICATION [23 marks]

For questions 2, 3, and 4: Remember to introduce variables to represent unknowns, draw a diagram if appropriate, set up the equations, solve for the unknowns, and conclude.

1. The following function gives the height, h metres, of a springboard diver above the surface of the water as a function of time, t seconds, since the diver leaves the diving board.

$$h = -4.9(t - 0.9)^2 + 6.95$$

Vertex $(0.9, 6.95)$

a) What was the maximum height of the diver?

[1] ∴ the max height of the diver is 6.95m.

b) After how many seconds did the diver reach their maximum height?

[1] ∴ after 0.9 secs the diver reached his max height.

c) What is the initial height of the diver?

set t = 0 solve

[2] $h = -4.9(0-0.9)^2 + 6.95$

$= 2.981$

∴ the initial height of the diver is 2.981m.

d) Find the height of the diver 0.5 seconds after the diver left the diving board.

sub 0.5 into t

[2]

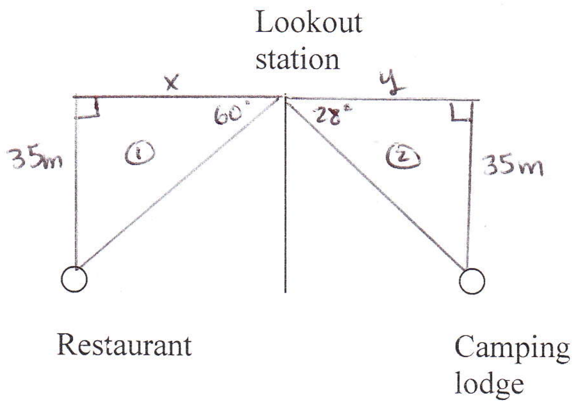
$= -4.9(0.5-0.9)^2 + 6.95$

$= -4.9(-0.4)^2 + 6.95$

$= 6.166$

∴ the diver is 6.166m in the air after 0.5 seconds.

2. From the top of a lookout station, the angle of depression to a camping lodge due east is 28° and the angle of depression to a restaurant due west of the station is 60°. If the tower is 35 m tall, how far apart are the camping lodge and the
[5] restaurant? (Complete the diagram by labeling the angles of depression).



$\Delta ①$

$\tan 60° = \frac{35}{x}$

$x = \frac{35}{\tan 60°}$

$x \doteq 20.21$

$\Delta ②$

$\tan 28° = \frac{35}{y}$

$y = \frac{35}{\tan 28°}$

$y \doteq 65.83$

total distance $= x + y$

$= 20.21 + 65.83$

$= 86.04$

∴ the restaurant & the lodge are 86.04m apart.

3. The cost of getting internet service from Boyle's Better Buy is a flat monthly fee of \$10, plus \$0.75 per hour spent on-line. Roberton's Rip Off charges a flat monthly fee of \$5, plus \$1.00 per hour spent on-line.

a) Using a system of linear equations, determine the number of hours spent online when the monthly costs are the same for these two companies.
b) What is the monthly cost at this number of hours?

let x represent hours spent online
let y represent total cost of internet

[5] ① $y = 0.75x + 10$ (Boyle's)

② $y = 1.00x + 5$ (Roberton)

Substitution

$1.00x + 5 = 0.75x + 10$

$1.00x - 0.75x = 10 - 5$

$\frac{0.25x}{0.25} = \frac{5}{0.25}$

$x = 20$

Sub x=20 into ①

$y = 0.75x + 10$

$= 0.75(20) + 10$

$= 15 + 10$

$= 25$

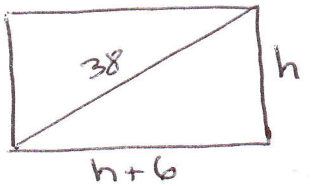
a) ∴ the cost will be the same for both companies if 20 hours are spent online.

b) ∴ the monthly cost will be \$25.

4. The size of a rectangular TV screen is defined by the length of its diagonal. A TV screen has a diagonal of 38 cm long. The width of the screen is 6 cm longer than its height. Determine the dimensions of the screen (width and height), to the nearest tenth of a centimeter.

let h represent height

[7]



$$a^2+b^2=c^2$$

$$(h+6)^2+h^2=38^2$$

$$(h+6)(h+6)+h^2=1444$$

$$h^2+6h+6h+36+h^2=1444$$

$$2h^2+12h+36-1444=0$$

$$\underset{a}{2h^2}+\underset{b}{12h}\underset{c}{-1408}=0$$

you can divide everything by 2 to make it easier

$$\frac{2h^2}{2}+\frac{12h}{2}-\frac{1408}{2}=\frac{0}{2}$$

$$\underset{a}{h^2}+\underset{b}{6h}\underset{c}{-704}=0$$

$$x=\frac{-6\pm\sqrt{6^2-4(1)(-7\ldots}}{2(1)}$$

same answers

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$=\frac{-12\pm\sqrt{12^2-4(2)(-1408)}}{2(2)}$$

$$=\frac{-12\pm\sqrt{11408}}{4}$$

OR

$$=\frac{-12-\sqrt{11408}}{4}$$

$$\boxed{\doteq -29.7}$$

Reject (can't have a negative measurement)

$$=\frac{-12+\sqrt{11408}}{4}$$

$$\doteq 23.7$$

height $= 23.7$
width $= 23.7+6$
$= 29.7$

$\therefore$ the dimensions of the screen are 23.7cm and 29.7cm.